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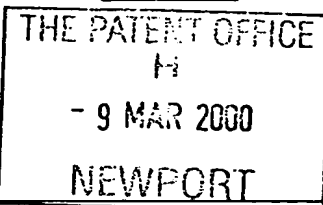
Dated

- 9 MAR 2001

**CERTIFIED COPY OF  
PRIORITY DOCUMENT**

**Request for grant of a patent**

(See the notes on the back of this form. You can also get an explanatory leaflet from the Patent Office to help you fill in this form)



The Patent Office

Cardiff Road  
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Gwent NP9 1RH

1. Your reference

GW-G29396

2. Patent application number

(The Patent Office will fill in this part)

09MAR00 E519549-5 D00346  
P01/7700 0.00-0005542.6

09 MAR 2000

**0005542.6**

3. Full name, address and postcode of the or of each applicant (underline all surnames)

**Pace Micro Technology Plc**

Victoria Road  
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Patents ADP number (if you know it)

If the applicant is a corporate body, give the country/state of its incorporation

U.K.

7588 569007

4. Title of the invention

**Control System for Storage Means**

5. Name of your agent (if you have one)

**Bailey Walsh & Co.**

"Address for service" in the United Kingdom to which all correspondence should be sent (including the postcode)

**5, York Place  
Leeds  
LS1 2SD**

Patents ADP number (if you know it)

**224001**

6. If you are declaring priority from one or more earlier patent applications, give the and the date of filing of the or of each of these earlier applications and (if you know it) the or each application number

Country

Priority application number  
(if you know it)

Date of filing  
(day / month / years)

7. If this application is divided or otherwise derived from an earlier UK application, the earlier application

Number of earlier application

Date of filing  
(day / month / years)

8. Is a statement of inventorship and of right to grant of a patent required in support of this request? (Answer "Yes" if:

**Yes**

- a) any applicant named in part 3 is not an inventor, or
  - b) there is an inventor who is not named as an applicant, or
  - c) any named applicant is a corporate body
- See note (d)

9. Enter the number of sheets for any of the following items you are filing with this form. Do not count copies of the same document.

Continuation sheets of this form

Description 5

Claim(s)

Abstract

Drawing(s) 1-1

10. If you are also filing any of the following, state how many of each item.

Priority Documents

Translations of priority documents

Statement of inventorship and right to grant of a patent (Patents Form 7/77)

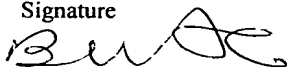
Request for preliminary examination and search (Patents Form 9/77)

Request for substantive examination (Patents Form 10/77)

Any other documents (Please specify)

11. I/We request the grant of a patent on the basis of this application

Signature



Date

08.03.00

12. Name and daytime telephone number of person to contact in the United Kingdom G Wood 0113 2433824

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## Control System for Storage Means

The invention to which this application relates is the provision of a system and control means which allows the storage and subsequent retrieval of data on a storage means such as, for example, a storage means in the form of, and known as, a hard disk drive. Furthermore the invention is related to the storage of data in the form of video, audio and/or data which is transmitted from a remote location and received by receiver apparatus for the processing and subsequent generation of video, audio, and/or data such as via a television screen connected to or including the receiver. In some instances the data is not decoded and displayed immediately and the decoding and/or the display of the data, when it does occur may be distant from the receiving and memory apparatus.

The receiver is typically provided in a location of a premises and is connected to a television set to allow received data to be processed and used to generate any, or any combination of television programmes, teletext and/or television programme guides.

In the most recent receivers for digital data there is provided a fixed memory device as part thereof such as a hard disk drive (HDD). The use of the storage means allows the data which is received to be stored and/or immediately used to generate a display or service and the selection to store the data is usually made as a result of user instructions to the apparatus or instructions from the service provider.

The volume of data represented by this video, audio and/or data is relatively large and, as a result, it can be difficult for manufacturers of the receivers to use the current international control standards for the storage and retrieval of data in this format, while at the same

time ensuring that, as much as possible, the system for storage and retrieval of the data is efficient and performed in a timely manner even though the volume of data is relatively high.

Conventionally, many individual register read and write functions are required to be performed in order to transfer relatively small amounts of data at a time. This means that the transfer of data of the volume with which the application is concerned, can cause the control system for the same to be unwieldy and furthermore, as the data received is changing and is required to be stored in real time, the control of this can also be difficult. Thus the aim of the invention is to provide a flexible, scalable mechanism that allows efficient data transfer using the current international standard and future international standards.

In fact at the present time, the procedure for storing the data requires that the streaming of the data into the storage means utilises six steps of protocol which are as follows:

1. 4 register writes to set the LBA (address) on the hard disk drive (HDD), the storage means.
2. 1 register write to indicate the 128KB transfer size (this is the maximum in accordance with the standard ATA-5).
3. 1 register write to command that bulk data be read or written from/to the HDD.
4. The HDD status register is repeatedly polled until the HDD is ready to commence the transfer.
5. Several signals are monitored during data transfer, also the HDD or host may "hold-off" (delay) the transfer of bytes during the transfer.
6. At the end of the transfer a check-sum is generated and compared to check the integrity of the data that has been transferred.

These six steps are currently required to be repeated for each 128 Kbytes of data to be stored in the memory.

One aim of the present invention is to reduce the number of steps required to store data in a storage means while at the same time utilizing existing storage means control systems. Furthermore, although reference is made herein storage means in the form of hard disk drives (HDD) it should be appreciated that the invention is equally applicable to any Advanced Technology Attachment (ATA) or Advanced Technology Attachment Packet Interface (ATAPI) compatible device including Compact Disk Read Only Memory (CD-ROM), Digital Versatile Disk (DVD), tapes and the like and should be interpreted as such.

In accordance with a first aspect of the invention there is provided a receiver for digital data which is broadcast from a remote location, said receiver including or connected to a storage means which allows the selective storage of received data therein and a control system for the control of the storage means and the storage of data therein and wherein the system includes a "first in first out" buffer (FIFO) which includes commands for the control system and the control of the storage of the data in the storage means.

Preferably the data which forms the data to be stored comprises instruction data and block data and the paths for said data are decoupled. Preferably the data generated for the FIFO is compatible with the commands that are used to automate the bulk transfer of the data to and from the storage means.

Typically, the analysis, storage and directing of the incoming data into the receiver is performed by a control processing unit (CPU) in the receiver. The receiver controls the data which is coming in and

then determines which of the data is to be stored and generates the signals for control of the FIFO.

In one embodiment the CPU loads the command signals data into the FIFO. The data can include data which is in the same form as it is received by the receiver, and/or data which is altered by the CPU and/or data generated by the CPU. Typical usage is that the CPU generates command signals and puts them into the FIFO. These command signals then instruct the transfer of data to/from the HDD via "Bulk Data Transfer Paths". In one embodiment, the command signals in the FIFO act to alter the start time for the storage of portions of incoming data and/or allows a combined set of command signals to be generated for a larger portion of data than is conventionally the case and, at the same time, reducing the number of steps required to be followed to allow the storage of the data in the storage means.

A specific embodiment of the invention is now described with reference to the accompanying drawings wherein;

Figures 1 and 2 illustrate embodiments of bulk data transfer paths and the storage means instruction FIFO respectively in accordance with the invention.

Referring now to the Figures, the data or storage space required during the bulk data transfer operation is provided by a management system 1. The management system can be controlled independently such that data for multiple data streams 3 can be multiplexed into a single stream 5.

The single FIFO 2 of storage means instructions allows the automation of the hardware synchronisation of the storage means and transfer means in terms of the same transferring the data and

doing so with the correct timing. Instructions are removed from the FIFO 2 and presented to the HDD 4 control lines 7 using the correct timings by an instruction sequencing system 8. The CPU 6 inserts new (groups of) instructions into the input of the FIFO 2.

In practice the presentation of the instructions from the FIFO to the HDD can be sent at the maximum possible rate and in practice will be limited only by the HDD.

The provision of each instruction in the FIFO 2 in a generic form allows any possible register read/write command to be sent from/to the attached ATA or ATAPI compatible device (i.e. HDD) and the additional information which is not used to provide the register read/write accesses to the HDD can be used to instigate the automated bulk transfer of the streamed data.

The provision of a single FIFO of generic HDD register read/write commands allows the same to be freely intermixed with commands that automate the bulk transfer of data to/from the ATA/ATAPI bus. More over, the data required during the bulk data transfer operation can, itself, be a multiplex of many data streams.

A mechanism that supports streaming AV data from/to a standard ATA-5 HDD is provided which again is generic and allows the use of newer HDD and other ATA or ATAPI compatible devices (including DVD).



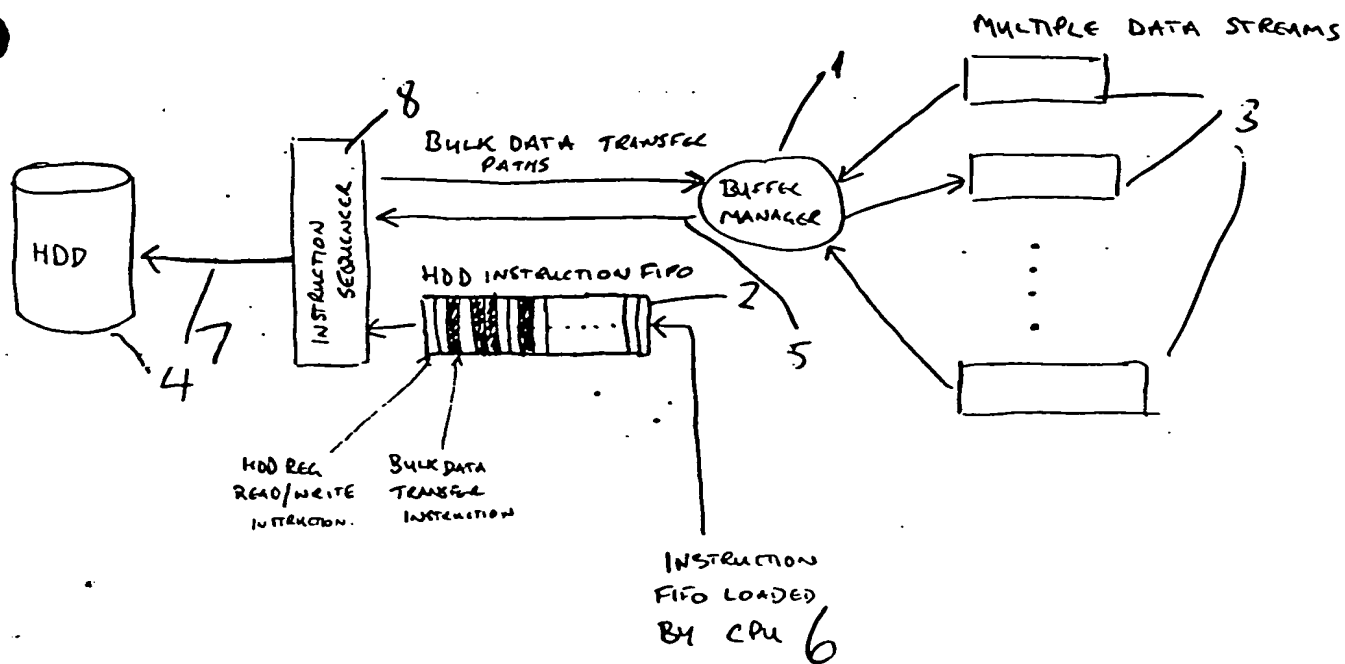


Fig 2: HDD INSTRUCTION FIFO.

